

A NEW SPECIES OF *SIROGONIUM* KÜTZING  
 FROM BIHAR (INDIA) :  
*SIROGONIUM IYENGARAI* SP. NOV.

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RÉSUMÉ. — Au cours de recherches sur les Conjugales de Bihar (Inde), a été observée une nouvelle espèce de *Sirogonium*. Cette espèce, mêlée à d'autres algues filamenteuses, a été récoltée à la fin de l'été 1976, dans des marécages de la région de Ranchi.

Cet article traite des aspects végétatifs et reproductifs de cette nouvelle espèce de *Sirogonium* observée à l'état frais et après fixation.

SUMMARY. — A new species of *Sirogonium* - *S. iyengarai* sp. nov. which approaches to *S. strictum* and *S. floridanum* is described and illustrated. It is based on an investigation of live as well as preserved specimens collected at Harmu, Ranchi, Bihar State, India. In this species the filaments demonstrate a peculiar tendency for looping in a profuse manner before conjugation. The same filament is capable of conjugation with a cell of its own filament or with a cell of another filament. Cross conjugation has also been recorded, a very rare phenomenon.

#### INTRODUCTION

During the course of investigation of the Conjugales of Bihar (India), a new species of *Sirogonium* along with other filamentous algae was collected from a wetland (paddy field) of Ranchi in the post-summer of 1976.

The present paper deals with the vegetative and reproductive feature of the new species of *Sirogonium*, based on a study of living as well as preserved specimens.

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## MATERIAL AND METHODS

A collection of floating filamentous algae rich in Zygnemacaea was made from the edge of an Indian paddy field (Harmu), some 4 kilometers west of Ranchi, Bihar during the post-summer of 1976. *Sirogonium iyengarai* sp. nov. was a dominant organism in this sample which also contained some species of *Oedogonium* including *O. autumnale* and *O. flavescens*.

Material was preserved in 4-8% commercial formalin with a little of glycerine in a specimen tube for examination. Specimen were examined with a Carl Zeiss monocular research microscope using light attachment. Drawings were made with a camera lucida.

## OBSERVATIONS

Vegetative filaments are unbranched, more or less straight with rough surface and no rhizoidal branches (Fig. 1). The vegetative cell is cylindrical, length and breadth which vary from 145.0-188.5 $\mu$ m and 72.5-87.0 $\mu$ m respectively. Cells are about two times longer than broad. Cell wall is upto 72.25 $\mu$ m uniform in thickness and lacks an external pectose wall. There are usually 6 chloroplasts, grass-green in colour, more or less straight, narrow and curved at ends, containing conspicuous pyrenoids 10 to 12 per band and linear in arrangement (Fig. 2). The septum is of plane type (Fig. 3).

The alga reproduces sexually either by scalariform or self conjugation. Sometimes cross conjugation also takes place.

**Scalariform conjugation :** At the time of reproduction the chloroplast and nucleus of male cell moves toward the region of contact to the female cell. The female progametangium is loaded with starch and other food materials. Both the progametangia conjugates without division. A mucilagenous ring is seen at the point of contact between mating cells (Fig. 4). Flexing of filaments takes place during conjugation. The gametangia are cylindrical, short and reflexed, male gametangia, 159.5-174.0 $\mu$ m long and 83.37-87.0 $\mu$ m broad and female gametangia, inflated, 145.0-159.0 $\mu$ m long and 84.275-87.6 $\mu$ m broad. Zygospore is formed in the female gametangia. The mature zygospores are ellipsoid, 108.75-116.0 $\mu$ m long and 79.0-87.0 $\mu$ m broad, differentiated into three distinct layers; exospore thin, smooth and colourless, mesospore thick, smooth and yellow in colour (Fig. 6).

**Self conjugation :** An abnormal method of sexual reproduction observed in this alga is by self conjugation and this appears to be the normal regular process of conjugation in this species. Here the filaments form loops before the actual act of conjugation in a simple but unusual manner forming loops up to 8 cells (Fig. 5). A varying number of cells situated at different places in the same filament are thus brought, somewhat parallel to each other. There is also a lateral expansion of the male and female gametangia before the dissolution of the wall separating the conjugants. Stages in the development of the male gamete, its movement towards the female cell through the point of gametangial

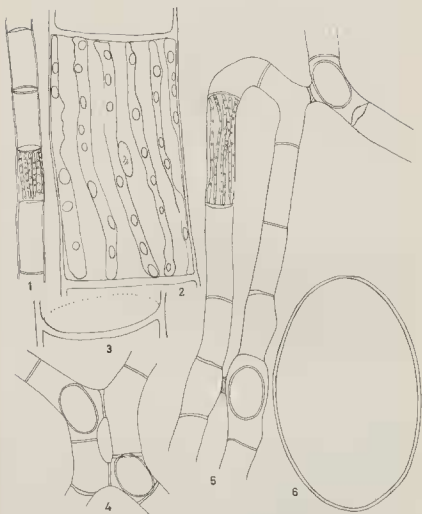


Planche I. — Fig. 1 : A portion of vegetative filament, x 175. Fig. 2 : Vegetative cell showing chloroplasts, x 826. Fig. 3 : Plane end wall, x 825. Fig. 4 : Two conjugating filaments showing cross conjugation, x 175. Fig. 5 : Filaments showing scalariform conjugation as well as self conjugation, x 175. Fig. 6 : Zygospore, x 1750.

contact leading to ring formation, the process of gametic union and place of zygospore occurrence are exactly similar to those known in the scalariform conjugation of this or other recorded species of *Sirogonium*. All the zygospore details much alike as observed for scalariformly formed in this species.

**Cross conjugation** : Certain cells of the filaments act as males and others as females, leading to the development of normal and perfect zygospores (Fig. 4). It is exceedingly a rare phenomenon.

## DISCUSSION

The present alga resembles *Sirogonium sticticum* (Eng. Bot.) Kützing (KÜTZING, 1843; TRANSEAU, 1951; RANDHAWA, 1959) and *Sirogonium floridanum* (Transeau) Smith (TRANSEAU, 1915, 1934, 1951). The former has been reported from Africa, Australia, Europe, South America, United States of America, Italy, India and the latter from South Africa and United States of America. The features of similarity include : 1) Shape of vegetative cell, 2) Nature of septum, 3) Orientation of chloroplast, 4) Scalariform conjugation, and 5) Shape, layering, colour and smoothness of zygospore. The alga is sufficiently different from the two species mentioned above to be considered as a separate species (Table 1). It differs from *S. sticticum* in the possession of usually much broader vegetative cells, constant number of chloroplast, receptive gametangia more inflated and much broader zygospore. Inhaving within length of vegetative cell, scalariform mode of conjugation and the shape, colour and smoothness of the zygospores, the alga comes near to *S. floridanum* than to *S. sticticum* but is easily distinguished from the former by the broadness of vegetative cell, number of chloroplasts, inflation of receptive gametangia and size of zygospore. Besides this, the alga is unique in possessing a peculiar type of self as well as cross conjugations. These striking differences seem to warrant to the establishment of a new species which may be named, *S. iyengarai* sp. nov. in honour of late Professor M.O.P. IYENGAR, father of Indian Algology.

### Diagnosis

*Sirogonium iyengarai* sp. nov.

Vegetative cells 145.0-188.5 $\mu$ m long, 72.5-87.0 $\mu$ m broad with plane end walls; chloroplast 6, more or less straight, narrow in each cell conjugation scalariform; gametangia cylindric, short and reflexed; male gametangia smaller, 154.4-174.0 $\mu$ m long, 83.37-87.0 $\mu$ m; broad; female gametangia larger 145.0-159.0 $\mu$ m long, 84.275-87.646 $\mu$ m broad; zygospores ellipsoid 108.75-116.0 $\mu$ m long, 79.5-87.0 $\mu$ m broad; exospore thin, smooth and colourless; mesospore thick, smooth and yellow; self conjugation by loop formation with loop consisting of 4-8 cells; cross conjugation.

Collected in free floating stage from paddy fields of Harmu, Ranchi, in July 1978 along with species of *Oedogonium*.

The type specimen is deposited in Department of Botany, Ranchi University, Ranchi, India. Type : MADHAVI ACCZ/102.

### Latin diagnosis

*Sirogonium iyengarai* sp. nov.

*Cellulae vegetativae* 145.0-188.5 $\mu$ m longae, 72.5-87.0 $\mu$ m latae, cum parietibus apicalibus

planis; chloroplasti 6, fere recti, angusti in singularis cellulis; conjugatio scalariformis; gametangio cylindrica, brevia geniculata; gametangio mascula parviora, 154.5-174.0 $\mu$ m longae, 83.37-87.9 $\mu$ m latae; gametangio feminea maiora, 145.0-159.0 $\mu$ m longae, 84.275-87.646 $\mu$ m latae; zygospora ellipsoidea, 108.75-116.0 $\mu$ m longae, 79.5-87.0 $\mu$ m latae; exospora angusta, levis et incolor; mesospora crassa, levis et flava; self conjugatio loope formatio cum loope constricta, 4-8 cellulae; cross conjugatio.

Collecta libere natans in agris oryzae, Harmu, Ranchi in terti lebolamada Julii, 1978 cum *Oedogonium speciosus*.

Specimen typum, depositum in Botanicae Departmenti, Ranchi Universitatis, Ranchi, India. Typus: MADHAVI ACCZ/102.

TABLE 1: A comparison of related species of *Sirogonium*

Species	Vegetative cell	Nature of chloroplast and turnings	Nature of septum	Nature of conjugation	Zygospore
<i>S. sticticum</i> (Eng. Bot.) Kutzing  (Randhawa, 1959)	Cylindric, 38-56 x 80-300 $\mu$ m	3-6, nearly straight, or making 0.5 turn	Plane	Scalariform and cross conjugations direct between usually short and more or less reflexed gametangia; receptive gametangia inflated to 72 $\mu$ m	Ellipsoid sometimes more or ovoid 40-67 x 68-127 $\mu$ m median spore wall smooth yellow
<i>S. Floridanum</i> (Transeau) Smith  (Randhawa, 1959)	Cylindric, 56-66 x 120-335 $\mu$ m	4-5 nearly straight or making a half turn	Plane	Scalariform; direct gametangia shortened and reflexed, receptive gametangia inflated up to 135 $\mu$ m	Ellipsoid 75-105 x 95-135 $\mu$ m median spore wall yellow and smooth
<i>S. iyengarai</i> sp. nov.	Cylindric, 72.5-87 x 145-188.5 $\mu$ m	6, more or less straight	Plane	Scalariform, self and cross conjugations direct, gametangia cylindric, short and reflexed receptive gametangia inflated up to 87.6 $\mu$ m	Ellipsoid, 79.5-87 x 108.75-116 $\mu$ m median spore wall thick smooth and yellow

## ACKNOWLEDGEMENTS

The author expresses her indebtedness to Dr. J.P. Sinha, Professor and Head, Department of Botany, Ranchi University, India and Dr. M. N. Noor of the same department, for confirmation of my identification, helpful suggestions and facilities. Grateful thanks are due to Dr. P. Bourrelly, Professor, Muséum National d'Histoire Naturelle, France and Dr. Y.S.R.K. Sarma, Professor of Botany, Advance Centre in Botany, Banaras Hindu University, India for their valuable comments. Thanks are also due to Rev. Fr. V. Dierckx S. J., St. Xavier's College, Ranchi, for the latin diagnosis and to the authorities of Ranchi University, for research grants.

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